Kika de la Garza Plant Materials Center

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A GERMINATION STUDY AND AN EMERGENCE STUDY WITH FIVE ACCESSIONS OF CHLORIS SPP.

ABSTRACT

This report looks at two studies conducted in the winter of 1999 with three accessions of *Chloris pluriflora* and two accessions of *Chloris crinita*. The first study was a germination study, which found all three *Chloris pluriflora* accessions to have a germination average between eighty to eighty-five percent. In the same study, the two *Chloris crinita* accessions had germination averages of ninety-two and forty-five percent. It is our belief that the wide discrepancy between the two accessions occurred because the seed of the accession with the higher germination came from a stand of plants that had been irrigated; whereas the other accession's seed came from a non-irrigated plot.

The second study was an emergence study. Five accessions, three planting depths, and two soil types were used to create thirty possible accession/planting depth/soil type combinations. Each combination was replicated four times for a total of120 pots. Pot location for the study was completely randomized. Significant differences in emergence were found for both planting depth and soil type. Seeds had significantly higher emergence at the ¼" and ½" planting depths than at the 1" planting depth. Significantly higher emergence was also found for the clay versus the sandy soil. No significant accession or relication differences were found. These findings held true for both actual seed emeregence and emergence that had been adjusted for germination.

INTRODUCTION

Twoflower trichloris (*Chloris crinita)* and Fourflower trichloris(*Chloris pluriflora)* are two warm-season perennial grasses native to Texas (Hitchcock, 1971). They are of particular interest because USDA-NRCS soil surveys have reported that twoflower and fourflower trichloris are co-dominant, climax species on numerous range sites in South Texas. Twoflower trichloris is more commonly known today as false rhodesgrass (Gould, 1975). False rhodesgrass can be found on plains, in canyons, and on rocky hills. It grows from Texas to Arizona, down into northern Mexico, and in the southern part of South America (Correll & Johnston, 1996; Hitchcock, 1971). Fourflower trichloris is more commonly known today as multi-flowered false rhodesgrass (Gould, 1975). Multi-flowered false rhodesgrass grows on plains and in dry woods in south Texas, Mexico, and in southern South America (Correll & Johnston, 1996;

Hitchcock, 1971). Although the presence of false rhodesgrass and multi-flowered false rhodesgrass is considered to be an indicator of good range condition; there are no known commercial varieties of these two chloris species.

Kika de la Garza Plant Material Center in Kingsville, Texas has been evaluating accessions of both false rhodesgrass and multi-flowered false rhodesgrass. Based on initial field data and observations, two accessions of false rhodesgrass and three accessions of multi-flowered false rhodesgrass have been selected for further evaluation at the Center, and at field sites. The selected accessions have been evaluated for survival, plant hardiness, foliage production and density, seed production, germination, and other factors that make them desirable range plants for south Texas.

The emergence study and the germination study were conducted as part of the ongoing evaluation of these five chloris accessions. The goal of the emergence study was to evaluate plant emergence of the five selected accessions at a variety of planting depths, in both clay and sandy soils. Additionally, information from this study was used to develop planting recommendations for each of the five selected trichloris accessions. The goal of the germination study was to obtain a germination average for each accession that will aid in the calculation of a recommended seeding rate. Results from this study were also used to calculate an adjusted emergence statistic for each pot in the emergence study. These statistics can be used to compare the emergence for the different accessions as if individualized planting rates were used.

MATERIALS AND METHODS

Five accessions of trichloris were used for this study. Accession numbers 43279, 45766, and 45825 are three multi-flowered false rhodesgrass accessions that were selected by the staff at the Kika de la Garza Plant Material Center for further study based on superior survival, forage production, seed production, germination, and other desirable plant characteristics. Accession numbers 38805 and 43462 are both false rhodesgrass accessions that have shown themselves to be superior in field studies at the Plant Materials Center, and have also been selected for further evaluation.

The Germination Study

Seeds of each of the five chloris accessions were placed in plastic trays in a controlled germination chamber. Each of the plastic trays contained 50 seeds of one of the five accessions placed in five rows of ten on two sheets of germination blotter paper that had been premoistened with de-ionized water. The trays were then covered and placed in a random location on shelves within the chamber. Trays were checked and rotated on a daily basis for 14 days beginning on February 22,1999. Three replications of each accession were used for this study.

The Emergence Study

For this study, 25 seeds of each of the five trichloris accessions were planted in 6-inch pots. Two soil treatments were used for this study: sandy soil and clay soil. The sandy soil treatment consisted of a 50/50 mix of potting soil and sterilized sand. The clay soil treatment consisted of sterilized Victoria Clay from Block K of the Kika De La Garza Plant Materials Center. Separate pots were used for each accession, each soil treatment, and each planting depth. Plantings were done at ¼ ", ½", and 1" depths in the sand soil treatment, and in the clay soil treatment.

Pots were labeled by accession, soil treatment, planting depth, replication number, and pot location number. The pot location number was included for ease of recording only. For the sand soil treatment, the pots were filled with the sandy soil mix to a 2" depth. Seeds were then arranged on the soil and covered by ¼", ½", or 1" of the sandy soil mix, according to a preset mark on the inner wall of the pot. For the clay soil treatment, pots were filled with the clay soil to a 2" depth. Then, once the seeds were arranged on the soil bed, they were covered by either ¼", ½", or 1" of the clay soil, according to a preset mark on the inside of the pot. All pots were set in the greenhouse on a table with premoistened capillary matting so that all pots had equal access to water.

Pots were placed on the table in a completely random design, and spaced evenly apart. The order of planting depths, soil treatments, replications, and accessions were all chosen randomly. The capillary matting was remoistened as needed. All pots in the study were checked daily for new seedlings starting on January 8, 1999, the day after planting. A total count was made at the end of 45 days. There were four replications of each accession/soil treatment/planting depth combination.

RESULTS AND DISCUSSION

Statistical Analysis was conducted using SPSS 8.0 for Windows. A one-way ANOVA was run to determine if there were significant differences in germination between accessions and replications. In addition, Tukey's Test for Honestly Significant Difference (Tukey's HSD) was run to pinpoint specific differences. A Univariate Analysis of Variance was used to determine if there were significant differences in emergence between accessions, soil types, planting depths, replications, and all possible interactions of the above four variables. In addition, Tukey's HSD was used to pinpoint specific differences. Descriptives tables were also run for both studies.

The Germination Study

A descriptives table (Table 1.) was used to obtain a mean germination percentage for each accession. False rhodesgrass #38805 had the highest mean germination percentage with 92% germination. This was followed by all three multi-flowered false rhodesgrasses which ranged from 81-83% mean germination. The second false rhodesgrass accession, #43462, had the lowest mean germination percentage with 45% germination. The results of a one-way ANOVA (Table 2.) determined that there was a siginificant difference between accessions at the .001 confidence level. Tukey's HSD found #43462 to have a significantly lower germination percentage than all four other accessions. Of specific interest to us was the large difference in mean germination between the two accessions of false rhodesgrass.

TABLE 1.

Descriptives Table for Accessions using Germination as the Dependent Variable

Accession	Count	Mean	SD	SE
279	3	83.3333^{A}	11.7189	6.7659
462	3	44.6667^{B}	10.2632	5.9255
766	3	82.6667^{A}	5.0332	2.9059
805	3	92.0000^{A}	7.2111	4.1633
825	3	80.6667^{A}	8.3267	4.8074
Total	15	76.6667	18.6036	4.8034

* Means with the same superscript are not significantly different

TABLE 2.

ANOVA Table for Accession using Germination as the Dependent Variable

	Df	Sum of Sq.	Mean Sq.	F.	Sig.
Between Groups	4	4066.667	1016.667	13.057	.001
Within Groups	10	778.667	77.867		
Total	14	4845.333			

It is believed, based on the results of previous germination studies that this significant difference in germination between the two acessions of false rhodesgrass is due in part to differences in the amount of water received by the plants during the months prior to harvest. The seed of the false rhodesgrass # 38805 was harvested from newly established plants which were irrigated on a regular basis; whereas, the seed from false rhodesgrass #43462 was harvested from an older, established plot which received no irrigation at all. Additionally, previous germination studies of the false rhodesgrass #43462 conducted at the Kika de la Garza Plant Materials Center in Kingsville, Texas have yielded germination perecentages higher than 90%. A future study is planned to compare germination in seed harvested from irrigated versus non-irrigated plots in the same harvest year.

The Emergence Study

A univariate ANOVA (Table 5.) was run to look for emergence differences based on accession, soil type, planting depth, replication, and all possible interactions of those four variables. No main effect differences were found based on accession or replication, nor were any interaction effects found. A planting depth difference was found. Seed planted at the I" depth had significantly less emergence than seed planted at either the ¼" or ½" depths(Table 3.). A difference in emergence between soil types was also found. Seed planted in the clay soil had significantly better emergence than seed planted in the sandier soil (Table 4.). When a second univariate ANOVA(Table 8.) was run using emergence data that had been adjusted for germination, the results were the same. Significant differences were found only for planting depth (Table 6.) and soil type (Table 7).

The significantly better emergence of seed planted in the clay versus the sandier soil is of particular interest. For the study, all pots were placed on moistened capillary matting which kept the soils consistently wet. This did not allow for the capping of the clay soil that generally occurs in South Texas and tends to reduce emergence. In the field, soils receive water from the top down, not the bottom up, and clay soils usually form a crust or cap as the soil dries out between rains. In this study, the majority of seedlings emerged in 7 to 21 days from consistently moist soils. A future study is planned to test how the amount and spacing of water received on clay soil impacts seed emergence in the field.

Table 3.

Descriptives Table for Planting Depth Using Actual Emergence as the Dependent Variable

Depth	N	Mean	SD	SE
.25”	40	25.3000[a]	13.6292	2.1550
.50”	40	22.6000[a]	14.9543	2.3645
1.00”	40	5.4000[b]	8.7612	1.3853
Total	120	17.7667	15.4162	1.4073

*Means with the same superscript are not significantly different

Table 4.

Descriptives Table for Soil Type Using Actual Emergence as the Dependent Variable

Soil Type	N	Mean	SD	SE
Clay	60	21.1333[a]	15.6762	2.0238
Sand	60	14.4000[b]	14.5103	1.8733
Total	120	17.7667	15.4162	1.4073

*Means with the same superscript are not significantly different

Table 5.

Univariate ANOVA Table Using Actual Emergence as the Dependent Variable

Source		Sum of Squares	Df	Mean Square	F	Sig.
ACC	Hypothesis	2268.800	4	567.200	2.551	.094
	Error	2667.733	12	222.311[a]		
DEPTH	Hypothesis	9321.867	2	4660.933	56.779	.000*
	Error	492.533	6	82.089[b]		
SOIL	Hypothesis	1360.133	1	1360.133	10.856	.046*
	Error	375.867	3	125.289[c]		
REP	Hypothesis	222.267	3	74.089	11.536	.991
	Error	57.798	9	6.422[d]		
ACC*DEPTH	Hypothesis	1228.800	8	153.600	.939	.504
	Error	3927.467	24	163.644[e]		
ACC*SOIL	Hypothesis	461.867	4	115.467	.715	.598
	Error	1938.133	12	161.511[f]		
DEPTH*SOIL	Hypothesis	21.067	2	10.533	.055	.947
	Error	1153.333	6	192.222[g]		
ACC*DEPTH* SOIL	Hypothesis	582.933	8	72.867	.774	.629
	Error	2258.667	24	94.114[h]		
ACC*REP	Hypothesis	2667.733	12	222.311	.962	.520
	Error	3371.036	14.590	231.044[i]		
DEPTH*REP	Hypothesis	492.533	6	82.089	.314	.914
	Error	2346.493	8.964	261.756[j]		
ACC*DEPTH* REP	Hypothesis	3927.467	24	163.644	1.739	.091
	Error	2258.667	24	94.111[h]		
SOIL*REP	Hypothesis	375.867	3	125.289	.483	.704
	Error	2011.185	7.747	259.622[k]		
ACC*SOIL* REP	Hypothesis	1938.133	12	161.511	1.716	.126
	Error	2258.667	24	94.111[h]		
DEPTH*SOIL* REP	Hypothesis	1153.333	6	192.222	2.043	.099
	Error	2258.667	24	94.111[h]		
ACC*DEPTH* SOIL*REP	Hypothesis	2258.667	24	94.111	.	.
	Error	.000	0	.[l]		

* = Significant

a. MS(ACC*REP)
b. MS(DEPTH*REP)
c. MS(SOIL*REP)
d. MS(ACC*DEPTH*REP)
e. MS(ACC*SOIL*REP)
f. MS(DEPTH*SOIL*REP)
g. MS(ACC*DEPTH*SOIL*REP)
h. MS(ACC*DEPTH*REP)+MS(ACC*SOIL*REP)-MS(ACC*DEPTH*SOIL*REP)
i. MS(ACC*DEPTH*REP)+MS(DEPTH*SOIL*REP)-MS(ACC*DEPTH*SOIL*REP)-MS(Error)
j. MS(ACC*SOIL*REP)+MS(DEPTH*SOIL*REP)-(MS(ACC*DEPTH*SOIL*REP)
k. MS(Error)

Table 6.

Descriptives Table for Planting Depth Using Adjusted Emergence as the Dependent Variable

Depth	N	Mean	SD	SE
.25”	40	32.5288[a]	17.1029	2.7042
.50”	40	29.8752[a]	20.4760	3.2375
1.00”	40	6.6425[b]	10.5515	1.6683
Total	120	23.0155	20.1521	1.8396

*Means with the same superscript are not significantly different

Table 4.

Descriptives Table for Soil Type Using Adjusted Emergence as the Dependent Variable

Soil Type	N	Mean	SD	SE
Clay	60	27.9460[a]	21.2176	2.7392
Sand	60	18.0850[b]	17.8735	2.3075
Total	120	23.0155	20.1521	1.8396

*Means with the same superscript are not significantly different

Table 8.

Univariate ANOVA Table Using Adjusted Emergence as the Dependent Variable

Source		Sum of Squares	df	Mean Square	F	Sig.
ACC	Hypothesis	482.536	4	120.634	.290	.879
	Error	4986.087	12	415.507[a]		
DEPTH	Hypothesis	16225.339	2	8112.664	73.693	.000*
	Error	660.520	6	110.087[b]		
SOIL	Hypothesis	2917.180	1	2917.180	14.259	.033*
	Error	613.748	3	204.583[c]		
REP	Hypothesis	433.033	3	144.344	3.595	.056
	Error	361.377	9	40.153[d]		
ACC*DEPTH	Hypothesis	1.435.308	8	179.414	.585	.780
	Error	7362.166	24	306.757[e]		
ACC*SOIL	Hypothesis	1251.875	4	312.969	.864	.513
	Error	4348.632	12	362.386[f]		
DEPTH*SOIL	Hypothesis	111.895	2	55.948	.142	.871
	Error	2364.990	6	394.165[g]		
ACC*DEPTH* SOIL	Hypothesis	1187.027	8	148.378	.902	.530
	Error	3946.319	24	164.430[h]		
ACC*REP	Hypothesis	4986.087	12	415.507	.823	.628
	Error	8040.027	15.930	504.713[i]		
DEPTH*REP	Hypothesis	660.520	6	110.087	.205	.967
	Error	4990.515	9.032	536.492[j]		
ACC*DEPTH* REP	Hypothesis	7362.166	24	306.757	1.866	.067
	Error	3946.319	24	164.430[h]		
SOIL*REP	Hypothesis	613.748	3	204.583	.346	.793
	Error	5468.316	9.235	592.121[k]		
ACC*SOIL* REP	Hypothesis	4348.632	12	362.386	2.204	.058
	Error	3946.319	24	164.43[h]		
DEPTH*SOIL* REP	Hypothesis	2364.990	6	394.165	2.397	.059
	Error	3946.319	24	164.43[h]		
ACC*DEPTH* SOIL*REP	Hypothesis	3946.319	24	164.430	.	.
	Error	.000	0	[l]		

* = Significant
a. MS(ACC*REP)
b. MS(DEPTH*REP)
c. MS(SOIL*REP)
d. MS(ACC*REP)+MS(DEPTH*REP)-MS(ACC*DEPTH*REP)+MS(SOIL*REP)-MS(ACC*SOIL*REP)-MS(DEPTH*SOIL*REP)+MS(ACC*DEPTH*SOIL*REP)+MS(Error)
e. MS(ACC*DEPTH*REP)
f. MS(ACC*SOIL*REP)
g. MS(DEPTH*SOIL*REP)
h. MS(ACC*DEPTH*SOIL*REP)
i. MS(ACC*DEPTH*REP)+MS(ACC*SOIL*REP)-MS(ACC*DEPTH*SOIL*REP)
j. MS(ACC*DEPTH*REP)+MS(DEPTH*SOIL*REP)-MS(ACC*DEPTH*SOIL*REP)-MS(Error)
k. MS(ACC*SOIL*REP)+MS(DEPTH*SOIL*REP)-(MS(ACC*DEPTH*SOIL*REP)
l. MS(Error)

REFERENCES

Correll, D. S., and Johnston, M.C., (1996). *Manual of the Vascular Plants of Texas.* Richardson, TX: The University of Texas at Dallas.

Gould, F. W. (1975). *The Grasses of Texas*. College Station, Texas: Texas A&M University Press.

Hitchcock, A. S. (1971). *Manual of the Grasses of the United States, Volumes 1&2, 2nd Edition*. Revised by Agnes Chase. New York: Dover Publications.
